Docket No.: 255898US0PCT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

IN RE APPLICATION OF: Jann SCHMIDT, et al.

GROUP: 1772

SERIAL NO: 10/501,925

EXAMINER: A. NASSAR

FILED: July 28, 2004

FOR: IMPROVED LIGHT-GUIDING BODIES AND METHOD FOR THE PRODUCTION THEREOF

**DECLARATION UNDER 37 C.F.R. § 1.132**

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

Sir:

Now comes Jann Schmidt who deposes and states that:

1. I am a graduate of TU Braunschweig and received my Chemist Ph.D. degree in the year 1990.

2. I have been employed by Roehm GmbH for 16 years as a Manager in the field of Plastic Processing.

3. Edge lit light guiding bodies that contain light scattering spherical particles traditionally have faced the problem that in order to get good light emission efficiency, the concentration of light scattering spherical particles has to be comparatively high. The presence of a high concentration of light scattering spherical particles, however, results in non-uniform distribution of light emitted from the light emitting surface(s) of the edge lit light guiding bodies. Alternatively, if the concentration of light scattering spherical particles is lowered, the distribution of light emitted from the light emitting surface(s) of the edge lit light guiding bodies becomes more uniform, but the light emission efficiency becomes poor.

I have found, surprisingly, by combining a low concentration of light scattering spherical particles (i.e., from 0.001 to 0.2% by weight of the light-guiding layer) and a light exit surface provided with structurings, in a light guide body as described in present Claim 1, that a synergistic effect occurs such that both light emission efficiency, expressed in $cd/m^2$, and

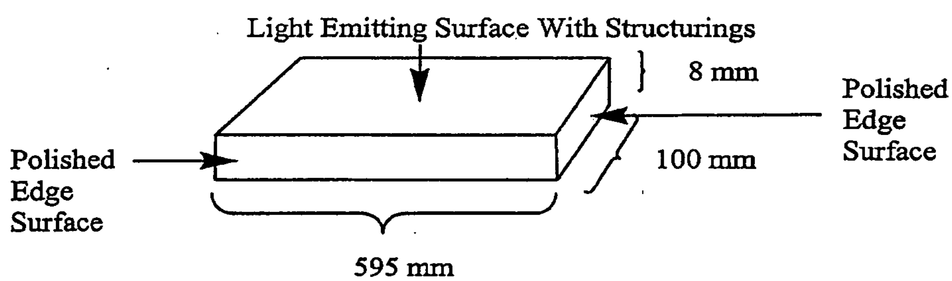
uniformity of total light emission, defined as the quotient of the minimum and the maximum of the emission efficiency (in $cd/m^2$) measured over representative points of the light emitting surface of a test sheet of a light guide body, improve. Thus, the addition of structurings on the exit surface of the presently claimed light-guide body, said structurings not being described or suggested in the Khanarian (US 5,881,201) reference, in combination a low concentration of light scattering spherical particles, produces a superior and unexpected result.

Example 1 – Formation of Sheets I and II

(Sheet I - of the invention): A mixture of methyl methacrylate monomers (refractive index 1.49) with 0.002% barium sulfate spherical particles (mean particle diameter = 3 $\mu m$; refractive index = 1.64) was polymerized and hardened in a casting process in a mold consisting of two silica glass sheets, which were kept at a fixed distance apart and closed off by a surrounding lace. One of the silica glass sheets had a rough surface which was introduced by an etching process. The rough surface was placed on the inside of the mold. During the hardening process, the rough structure of the silica glass sheet was transferred onto the poly methyl methacrylate sheet.

(Sheet II - not of the invention): A second poly methyl methacrylate sheet was produced in the same manner, but without the admixture of barium sulfate spherical particles.

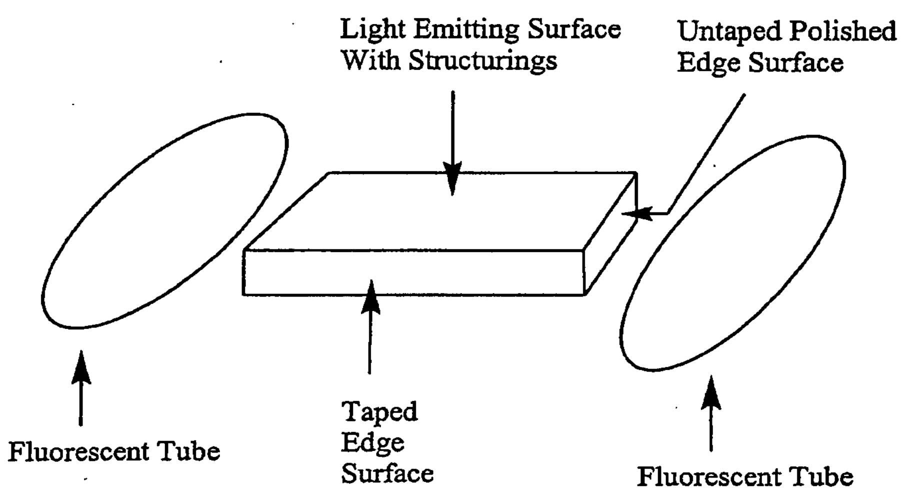
Both Sheet I and Sheet II were cut to dimensions of 595 mm in length, 100 mm in broadness, and 8 mm in thickness. Both sheets were polished at all four edge surfaces. In the simplified drawing (below), two of the four polished edge surfaces are visible, the other two polished edges, and one face, have been omitted for clarity. (For an non-simplified drawing, see generic attached Figs. A and B):



Method of Measurement for Sheets I and II

On the polished edges (rims) which were 595 mm in length, reflecting tape (number 10 in generic attached Fig. B) from the 3M company (type: Scotch Brand 850) was applied, so that light could be reflected from these two edge surfaces back into the sheets.

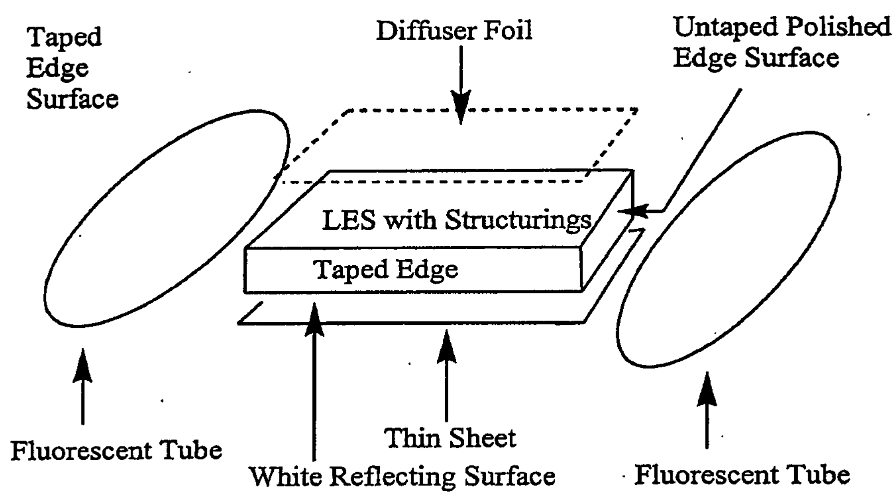
The sheets (number 6 in generic attached Figs. A and B) were each placed in measuring equipment. The measuring equipment consisted of two rectangular aluminum frames, 708 mm in length and 535 mm in broadness (number 4 in generic attached Figs. A and B). At the two polished edge surfaces of each sheet which were 100 mm in length, on the parts of the rectangular aluminum frames which were 535 mm in broadness, two fluorescent tubes (number 5 in generic attached Figs. A and B) of the type PHILLIPS TLD 15W/4 were fixed parallel to each other. The distance of the fluorescent tubes was 599 mm, and the sheets were placed centric between the fluorescent tubes so that light was emitted from the fluorescent tubes into the adjacent polished edges of the sheets which were 100 mm in length, as also shown in the drawing below (note: in the simplified drawing below, only one taped edge, one polished edge, and one face are shown, and the rectangular aluminum frames have been omitted for clarity. For a non-simplified drawing, see generic attached Figs. A and B):




Below the sheet (number 6 in generic attached Figs. A and B) was placed a thin sheet (number 8 in generic attached Fig B) with a white reflecting surface (number 11 in generic

attached Fig. B). The white reflecting surface of the thin sheet occupied the position opposite the "observer" and sent back any light that emerged from the surface of the sheet which faced the white reflecting surface.

Above the sheet (number 6 in generic attached Figs. A and B) in the direction occupied by the observer was placed a diffuser foil (number 9 in generic attached Fig. B) which had a thickness of 0.5 mm. Onto the diffuser foil seven measuring points (number 7 in generic attached Fig. A) were marked, and the light intensity was determined at each marked point by a light intensity measuring equipment type MINOLTA LUMINANCE METER 1°. The measuring points were positioned, measuring a distance from one of the untaped polished edges which had a broadness of 100 mm: 74 mm, 149 mm, 223 mm, 298 mm, 372 mm, 446 mm, and 521 mm distant. A simplified drawing of the set-up is shown below:




Note: in the above-drawing, LES = Light Emitting Surface.

Table 1 lists the measured light intensity values:

**Table 1. Light Intensity Measurements.**

| Distance From The Untaped Polished Edge With a Broadness of 100 mm (in mm) | Light Intensity of Sheet II (Not of the Invention – No Spherical Barium Sulfate Particles) in cd/m$^2$ | Light Intensity of Sheet I (Of the Invention – Contains Spherical Barium Sulfate Particles) in cd/m$^2$ |
|---|---|---|
| 74 | 110 | 120 |
| 149 | 97 | 104 |
| 223 | 90 | 95 |
| 298 | 88 | 93 |
| 372 | 93 | 96 |
| 446 | 105 | 110 |
| 521 | 138 | 142 |

As can be seen from Table 1, the light intensity, for every measured point, was superior in Sheet I (of the invention) when compared to Sheet II (not of the invention). The light intensity, on average, increased by 5.6 cd/m$^2$ in inventive Sheet I, when compared to non-inventive sheet II.

Further, the uniformity of light intensity increased from 0.64 in Sheet II (not of the invention) to 0.65 in Sheet I (of the invention).

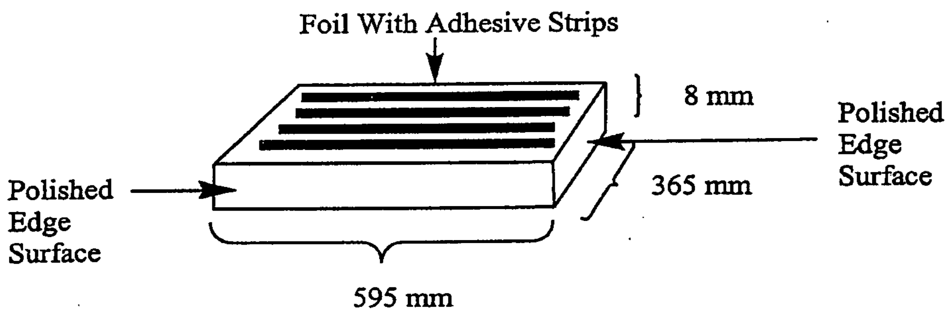
<u>Example 2 – Formation of Sheets III and IV</u>

Polymethyl methacrylate sheets were prepared by an extrusion process of the transparent moulding compound PLEXIGLAS®7H (refractive index = 1.49) with (Sheet III – of the invention) and without (Sheet IV – not of the invention) the addition of 0.001% of poly styrene pearls crosslinked with divinyl benzol. The crosslinked pearls had an average diameter of 8 μm and a refractive index = 1.59.

Both sheets were cut to dimensions of 595 mm in length, 365 mm in broadness, and 8 mm in thickness. Both sheets were equipped on one side with a foil (number 12 in generic

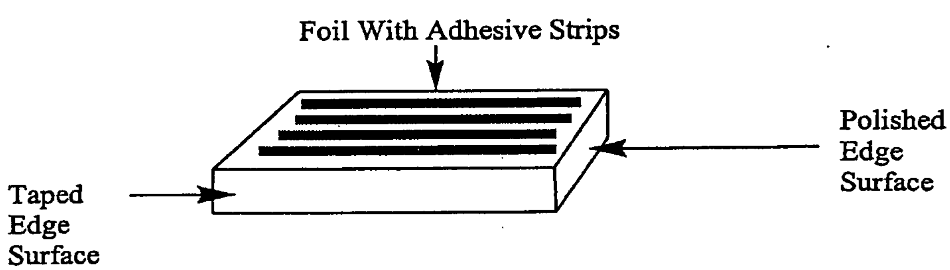
attached Fig. C) carrying adhesive stripes (number 13 in generic attached Fig. C) that functioned as a surface structuring that interrupts the total reflection. The adhesive stripes were applied along with the direction of the incident light from 365 mm edges of the sheets. The adhesive stripes were separated from each other by approximately 20 mm and were about 2 mm in broadness in the middle of each stripe and reduced in broadness towards the edges of the each stripe. Both sheets were polished at all for angle surfaces to a high glance.

In the Simplified drawing (below), two of the four polished edge surfaces, and one face, are visible, the other two polished edge surfaces have been omitted for clarity, and the foil, attached with adhesive strips to one face of the sheet, is shown:

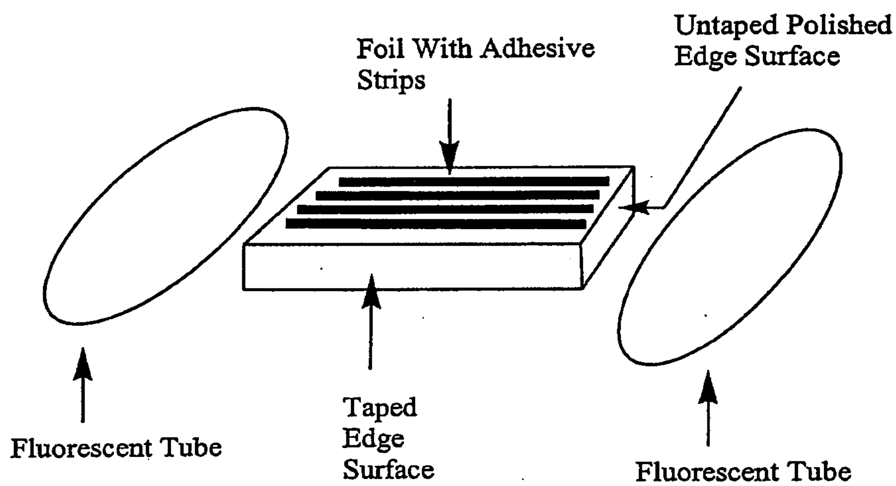



Method of Measurement for Sheets III and IV

On the polished long edges which were 595 mm in length, reflecting tape material (number 10 in generic attached Fig. A) from the 3M company (type: Scotch Brand 850) was applied, so that light could be reflected from these edge surfaces back into the sheets, as shown in the simplified drawing below (note: Two edges and a face have been omitted for clarity):



The sheets (number 6 in generic attached Figs. A and B) were each placed in measuring equipment. The measuring equipment consisted of two rectangular aluminum frames, 708 mm in length and 535 mm in broadness (number 4 in generic attached Figs. A and B). At the two polished edge surfaces of each sheet which were 365 mm in length, on the parts of the rectangular aluminum frames which were 535 mm in broadness, two fluorescent tubes (number 5 in generic attached Figs. A and B) of the type PHILLIPS TLD 15W/4 were fixed parallel to each other. The distance of the fluorescent tubes was 599 mm, and the sheets were placed centric between the fluorescent tubes so that light was emitted from the fluorescent tubes into the adjacent polished edges of the sheets which were 365 mm in broadness, as also shown in the drawing below (note: In the simplified drawing below, only one taped edge, one polished edge, and one face are shown, and the rectangular aluminum frames have been omitted for clarity. For a non-simplified drawing, see generic attached Figs. A and B):

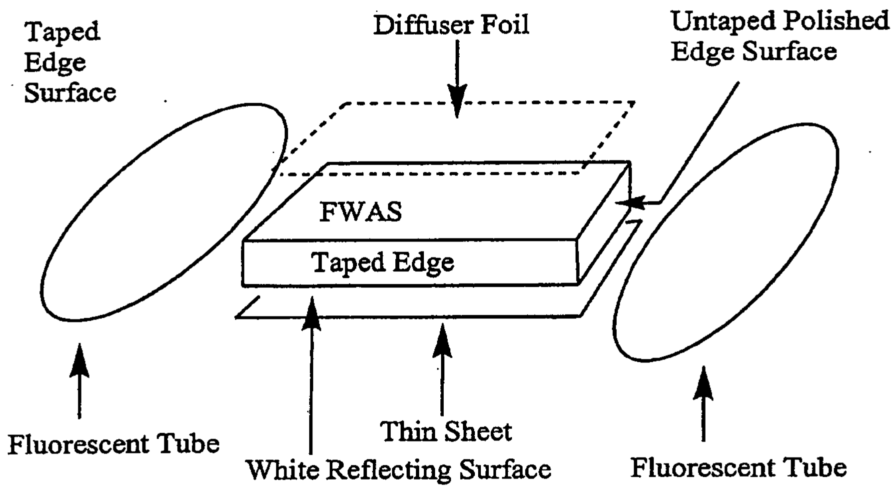



Below the sheet (number 6 in generic attached Figs. A and B) was placed a thin sheet (number 8 in generic attached Fig B) with a white reflecting surface (number 11 in generic attached Fig. B). The white reflecting surface of the thin sheet occupied the position opposite the "observer" and sent back any light that emerged from the surface of the sheet which faced the white reflecting surface.

Above the sheet (number 6 in generic attached Figs. A and B) in the direction occupied by the observer was placed a diffuser foil (number 9 in generic attached Fig. B). Onto the

diffuser foil seven measuring points (number 7 in generic attached Fig. A) were marked, and the light intensity was determined at each marked point by a light intensity measuring equipment type MINOLTA LUMINANCE METER 1°. The measuring points were positioned, measuring a distance from one of the untaped polished edges which had a broadness of 365 mm: 60 mm, 119 mm, 179 mm, 238 mm, 298 mm, 357 mm, 417 mm, 476 mm, and 536 mm distant.

A simplified drawing of the set-up is shown below:




Note: in the above-drawing, FWAS = Foil With Adhesive Strips.

Table 2 lists the measured light intensity values:

**Table 2: Light Intensity Measurements.**

| **Distance From The Untaped Polished Edge With a Broadness of 365 mm (in mm)** | **Light Intensity of Sheet IV (Not of the Invention – No Polystyrene Pearls) in cd/m$^2$** | **Light Intensity of Sheet III (Of the Invention – Polystyrene Pearls Present) in cd/m$^2$** |
|---|---|---|
| 60 | 125 | 133 |
| 119 | 107 | 114 |
| 179 | 91 | 98 |
| 238 | 79 | 84 |
| 298 | 73 | 87 |
| 357 | 75 | 87 |
| 417 | 92 | 102 |
| 476 | 111 | 120 |
| 536 | 118 | 135 |

As can be seen from Table 2, the light intensity, for every measured point, was superior in Sheet III (of the invention) when compared to Sheet IV (not of the invention). The light intensity, on average, increased 10.4 cd/m$^2$ in inventive Sheet III, when compared to non-inventive sheet IV.

Further, the uniformity of light intensity increased from 0.58 in Sheet IV (not of the invention) to 0.62 in Sheet III (of the invention).

4. The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

5. Further deponent saith not.

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Signature

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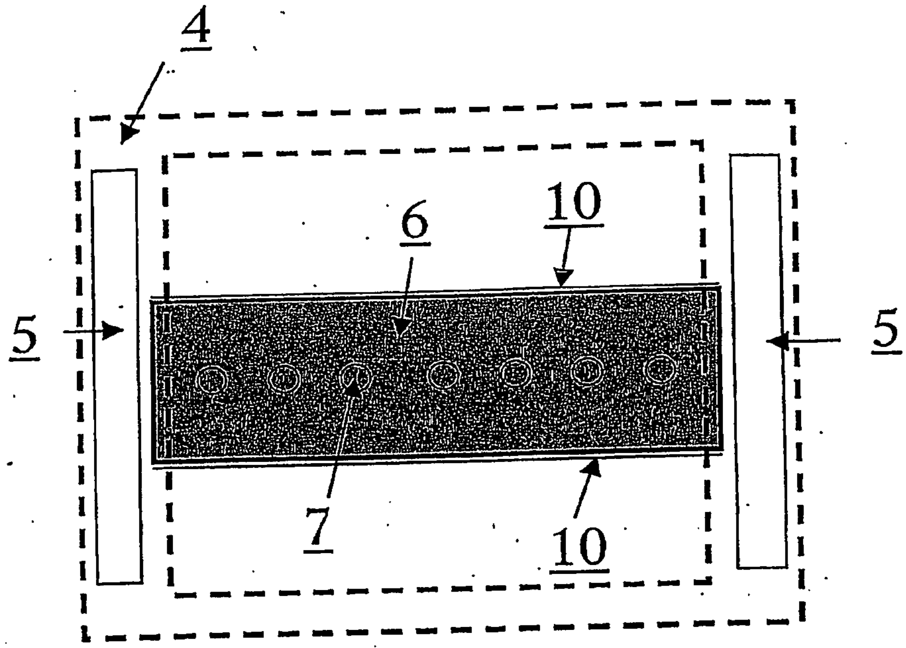


Fig. A

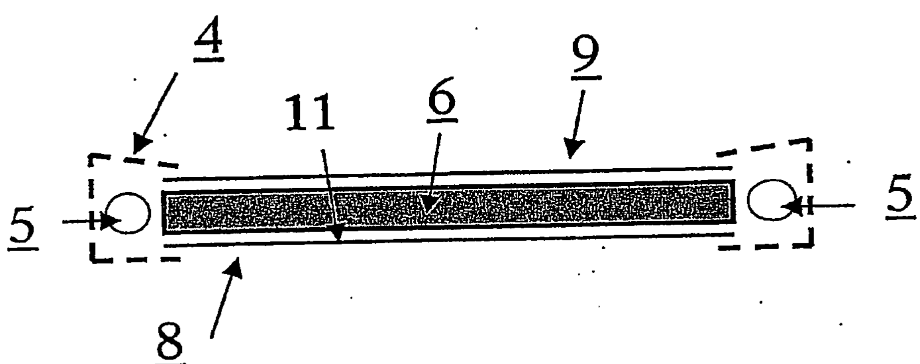


Fig. B

Fig. C